Prof. Barrett's, that the effect of longitudinally magnetising a bar of iron, or of increasing its magnetisation, is to increase its dimensions longitudinally and to diminish them laterally, so that the volume remains constant; and on the other hand, from Sir William Thomson's investigations, that the effect of increase of longitudinal dimensions in an iron bar is to increase, and of increase of transverse dimensions to diminish its longitudinal magnetisation.

This analogy holds also with reference to steel and nickel. In the case of bars of these metals, we found their longitudinal magnetisation to be diminished by the application of longitudinal pull, and Prof. Barrett has found that bars of the same metals undergo a shortening when their longitudinal magnetisation is increased.

In the case of cobalt, however, the results do not agree. The results for cobalt, given in Sir W. Thomson's paper, are somewhat anomalous, but they refer only to the effect of stress on magnetism in a bar which had been previously magnetised and then placed while being experimented on, under the influence of the earth's vertical force The results were therefore complicated by the effects of the stress on the residual magnetism. So far as these results go they bear out to some extent those found by Prof. Barrett, but further experiments, the results of which have not yet been published, prove that the effects of stress are the same as for nickel. This is the case at least for all but low magnetising forces.

The behaviour of cobalt and nickel throughout a wide range of magnetising forces, and under the influence of both transverse and longitudinal stress, will, it is hoped, be fully investigated in a continuation of Sir William Thomson's experiments, begun some time ago, and temporarily interrupted by other, and for the time being, more pressing work, but now about to be resumed.

I may mention that my brother and myself pointed out in NATURE, vol. xviii. p. 329, the applicability of a modification of Edison's Tasimeter to the measurement of the changes of dimensions produced in a body by magnetisation. We still think that this is perhaps the most simple method, and we have found it very sensitive for qualitative results. In our trials of it we have experienced some difficulty in obtaining a carbon button which would return after having been subjected to stress to the same resistance as before. The experiments of Prof. Mendenhall, however, show that the kind of carbon used by Edison in his Tasimeter possesses this property in perfection; and we hope soon by the use of this carbon to obtain quantitative results.

ANDREW GRAY

The Physical Laboratory, the University, Glasgow,
October 19

Aurora

AN aurora was seen at Croydon at about 7 p.m. on Wednesday, the 18th inst. Three streamers of a whitish colour could be traced distinctly across the whole of the sky while the moon was still up.

A. E. EATON

The Victoria Hall Science Lectures

THE popular science lectures at the Victoria Hall have proved quite sufficiently successful, so far, to make the managers wish to continue them, provided that the kindness of competent lecturers makes it possible to do so. There have been audiences each night of ab ut 600—small compared with what the building will hold, but not amiss for a Friday night, in a neighbourhood where (except on Saturdays) people think twice before spending a penny. Those who have been present, agree in describing the audience as a peculiar one, for whom greater simplicity is needed than for the audiences of mechanics' institutes, and the frequenters of penny science lectures in general. They are quite ready to attend and to be interested, and do not think an hour too long, provided the ball is kept constantly moving, but as to this they are very exacting, and any breakdown of the apparatus, however temporary, places the success of the lecture in serious danger. There are stamps and whistles of impatience at any pause, such as must occur in adjusting experiments, but these cease the moment the lecture proper proceeds. This impatience perhaps makes the sustained interest of a lantern more suited to the audience than the more varied but intermittent experiments.

It is to be wished these lectures could be more widely known among the artisan class, who have not too many opportunities of hearing sound popular science.

ONE OF THE COMMITTEE

Royal Victoria Coffee Hall, Waterloo Road, S.E., October

THE TYPHOONS OF THE CHINESE SEAS[1]

THIS work by the learned director of the Zi-Ka-Wei Observatory, consisting of 171 pages quarto, and eight illustrative plates giving the tracks of the twenty typhoons of 1881, may be regarded as the outcome of the recent establishment of meteorological stations over the regions swept by the typhoon. The typhoons of 1880, amounting to fourteen, were described by Father Dechevrens in a previous paper. These two papers, from the greater fulness and accuracy of their details, form a contribution of considerable importance to the literature of cyclones.

An examination of the tracks of these thirty-four typhoons shows that they generally have their origin in the zone comprised between the parallels of 10° and 17°, some of them originating in the Archipelago of the Philippines, but the greater number to the eastward of these islands in the Pacific. The first part of their course is westerly and north-westerly; they then recurve about the latitude of Shanghai, and thence follow a north-easterly course over Japan. During the first half of their course the barometric gradients are steepest, and the destructive energy of typhoons is most fully developed; but after advancing on the continent, and, particularly after recurving to eastward, they rapidly increase in extent, form gradients less steep, and ultimately assume the ordinary form of the cyclones of North-Western Europe. In illustration of the steepness of the gradients sometimes formed, it is stated that on July 15 a gradient occurred of 2·760 inches per 100 miles, or one inch to 36 miles.

Typhoons do not occur during the prevalence of the north-east monsoon from November to May. In 1881 the typhoon season extended from May 22 to November 29. In Japan the true typhoon season is restricted to August and September, the storms there during the other months resembling rather the ordinary cyclones of temperate regions. The tracks of the typhoons during the months of moderate temperature, May, June, the latter half of September, October, and November, are the most southerly; they lie flattest on the parallels of latitude, and present a great concavity looking eastward; but those of the warmer months, July, August, and the beginning of September, exhibit, on the other hand, very open curves. This seasonal difference in the form of the tracks, taken in connection with the general form of the recurving tracks of the West Indian hurricanes, which are less open than those of the Chinese seas, suggests a possible connection between the forms of these curves and the different distributions of atmospheric pressure prevailing over the continents at the time.

Of the new facts brought forward in this report, the most important perhaps are those which show that the typhoon tracks have the feature of recurvation as distinctly as the hurricanes of the West Indies and the Indian Ocean. The degree of recurvation and the relative frequency with which it occurs in the tracks of the cyclones of the Chinese seas, the West Indies, the Indian Ocean near Madagascar, and the Bay of Bengal respectively, are important features in the history of these storms, which such reports will do much to elucidate. We shall look forward with the liveliest interest to Father Dechevrens' future reports, which from the lines of inquiry already indicated may be expected to throw considerable light on the influence of extensive regions of dry air and of moist air respectively, and of elevated

[1] "The Typhoons of the Chinese Seas in the Year 1881." By Marc Dechevrens, S.J., Director of the Zi-Ka-Wei Observatory, China. (Shanghai: Kelly and Walsh, 1882.)

table-lands, in determining the continuance and the direction of the course of cyclones; and the influence of isolated mountains and mountainous ridges in breaking up a cyclone into two distinct cyclones, which, from the difficulty necessarily experienced by seamen in interpreting the complex phenomena attending them, often prove so destructive in their effects.

SEISMOLOGY IN JAPAN

THE first earthquake that I ever felt took place about 2 a.m. on the night of April 10, 1876. On this night, which was soon after my arrival in Yedo, I had been installed in a new house. To be absolutely alone in a large partially furnished dwelling in a strange land, and then in the dead of night to be wakened by a swinging motion of the bedstead, a rattling of windows, creaking of timbers, and flapping of pictures was more than bewildering.

For some time after the motion had died away, which motion had several maxima and minima, some little rings upon the bedstead which had been caused to swing, kept up a gentle clicking, and a night light upon a basin of oil as it swayed from side to side cast long flickering shadows across the room. The general behaviour of things was ghostly, and it was some time before I could assure myself that what I had experienced was an earthquake.

Next morning, however, my doubts were dissipated by my neighbours making jocular inquiries about the nature of my experiences. Earthquake conversation, I may remark, is often used in Yedo to fill up the gaps in conversation, which in England are usually stopped by queries and truisms about the weather. This was my first earthquake.

Palmieri's instrument indicated that its direction was about E.S.E. to W.N.W., and its force was 6 degrees. By 6 degrees is meant that the shaking caused some mercury contained in a glass tube to wash up and down until a little string attached to an iron float on its surface had turned a pully and a pointer through 6°. By observing the tables of these indications it is seen that a very gentle shaking of long duration may get up a violent oscillation in the mercury and so indicate a shock of a great number of degrees, whilst a violent sharp shock, which might knock over a chimney, may possibly only indicate a few degrees.

Since my first earthquake I have had the opportunity during the last six years of studying rather more than 400 other shakings. One of these shook down chimneys, unroofed houses, twisted gravestones, and by its action generally entitled itself to be called destructive and alarming. The effect that this earthquake produced upon the nerves of many people was quite as great as that which might be produced upon children with an imaginary ghost. As residents in Japan are so often alarmed by earthquakes it is only natural that they should be led to study these phenomena. Amongst the first instruments which were employed for their investigation were, as might be anticipated, small columns, bowls of liquid, and other contrivances, which are found described in books and papers treating of observational seismology.

Columns which have been made of various shapes and various materials have been found unsatisfactory, because it is seldom (even when a house may be swaying violently), if they are on a stone platform *firmly* fixed to the ground that they are overturned. When it happens that they are overturned, if there were several columns side by side you would usually find them lying pointing like the arms of a star-fish in different directions. If an earthquake was a sharp blow, no doubt the columns would fall in the direction of the shock and also towards the point from which the shock came. Yedo earthquakes, however, commence gently, and the column is caused to rock before it falls, and as it rocks its plane of rocking may be gradually changed. Another explanation would be that some of the columns had fallen with direct shocks and some with reflected shocks, or that some were overturned with the normal and some with the succeeding transverse vibrations.

Bowls of liquid have been found impracticable; first, because it is seldom that in a bowl on a *firm foundation* a sufficiently measurable amount of washing up is obtained; and second, that any of the usual methods of registering the motion as well as many other methods, both chemical and mechanical which have been tried, are not satisfactory. Also there are the difficulties of freezing and evaporation to contend with.

Similarly the records of the old-fashioned ordinary pendulum with a pointer resting in sand, or, what is perhaps better, provided with a sliding pointer writing over a smoked glass plate, are also very unsatisfactory. All that many of the carefully drawn records produced by *swinging* pendulums appear to indicate, is that there has been an earthquake, and it has caused the pendulum to swing about. For reasons like these, after considerable experience the conclusion arrived at is that the records of most of the older forms of seismographs and seismometers, of which legions have been experimented with, can only be regarded as being *seismoscopic*.

When we look into the history of observational seismology, and take the following description of a seismometer invented nearly 1800 years ago as a standard of comparison between the old and better known forms of earthquake instruments for registering *ordinary* shocks, it is doubtful whether this branch of earthquake investigation has been much advanced. This description was given to me by Mr. J. Hattori, vice-director of the Imperial University. It was translated for me by my assistant, Mr. M. Kuwabara. It runs as follows:—

In a Chinese history called "Gokanjo," we find the following: "In the first year of Yōka (A.D. 136) a Chinese called Chioko invented a seismometer. This instrument consists of a spherically formed copper vessel (Fig. 1), its diameter being 8 'shaku.' It is covered at its top. Its form resembles a wine bottle. Its outer part is ornamented with the figures of different kinds of birds and animals and old peculiar looking letters. In the inner part of this instrument a pillar is so placed that it can move in eight directions. Also in the inside of this bottle there is an arrangement by which some record of an earthquake is made according to the movement of the pillar. On the outside of the bottle there are eight dragon heads, each of which contains a ball. Underneath these heads there are eight frogs, so placed that they appear to watch the dragon's face, so that they are ready to receive the ball if it should be dropped. All the arrangements which cause the pillars when it moves to knock the ball out of the dragon's mouth are well hidden in the bottle. When an earthquake occurs and the bottle is shaken, the dragon instantly drops the ball, and the frog which receives it vibrates vigorously. Any one watching this instrument can easily observe earthquakes. With this arrangement, although one dragon may drop a ball, it is not necessary for the other seven dragons to drop their balls unless the movement has been in all directions; thus one can easily tell the direction of an earthquake. Once upon a time a dragon dropped its ball without any earthquake, and the people therefore thought that this instrument was of no use, but after two or three days a notice came saying that an earthquake had taken place in Rōsei. Hearing of this, those who did not believe about the use of this instrument began to believe in it again. After this ingenious instrument had been invented by Chioko, the Chinese Government wisely appointed a secretary to make observations on earthquakes."

We have here I think not only an account of an earthquake instrument which in principle is identical with many of our modern inventions, but the science has been conjoined with art. The record of the Chinese Government establishing a seismological bureau at a time when America was unknown, and half of Western Europe were